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NOTES ON THE ARTIFICIAL REGENERATION AND TENDING OF SANDAL

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NOTES ON THE ARTIFICIAL REGENERATION AND TENDING OF SANDAL.

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A.—GERMINATION.

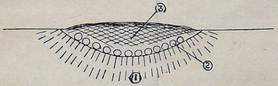
1. To induce rapid germination of sandal seed—

(1) Remove the outer skin and pulp from the seeds and sow.

This method has been markedly successful in Kollegal where up to 73 per cent germination has been obtained within three months of sowing.

(2) Dump a layer of whole seeds in a shallow saucer-like depression in which the soil has been worked up. Cover with damp straw. Such dumps may vary from a few inches in diameter and, say, half an inch in depth, up to 24 inches in diameter, and perhaps 2 inches in depth, according to the purpose for which they are required.

Figure I.—Dump of Sandal Seeds.



(1) Raked up soil.
(2) Layer of sandal seeds.
(3) Straw.

This method has met with marked success in North Salem, where profuse germination has been obtained within a month.

2. In both the above cases, water, if possible, twice a week. Germination will take place without watering but less rapidly and less completely.

3. Experiments are being conducted combining the two methods.

4. Always select seed carefully, from vigorous well-grown trees with thick, dark green leaves, growing in a healthy area.

5. Seed should be kept in covered tins.

6. There are indications in North Salem and Kollegal that seed collected in September-October is better than that collected in February-March.

7. In Kollegal it has been found that seed which floats when first immersed in water gives a higher percentage of germination than that which sinks. Further experiments are being made.

8. To prevent rats, etc., from eating the seed after sowing the best preventive has been found in North Salem to consist in smearing them with a mixture of powdered vasambu (i.e., the root of Acorus calamus) with water. The removal of the pulp probably also discourages damage by rats, etc.

In Coorg 70 per cent germination has recently been obtained by sowing the seeds 6 inches deep.

B.—RAISING SEEDLINGS.

(1) Dumps.

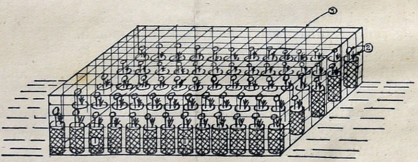
9. Prepare dumps for raising seedlings as described above, about 2 feet in diameter, but below the layer of sandal seeds and above the worked up soil put a layer of sand $\frac{1}{4}$ to $\frac{1}{2}$ an inch deep. This is to enable the seedlings to be pulled out readily, without damaging the roots, for transplanting.

10. Such dumps should be in the area where the planting out is to be done. The seedlings should be planted in prepared patches.

(2) Baskets.

11. Arrange baskets in rows close together, fill them with soil and sow several sandal seeds in each, together with the seed of some suitable small host (e.g., dhall, Acacia Farnesiana), not a tree species. Cover with damp straw to promote rapid germination, and with fine mesh wire netting to prevent damage by rats and squirrels. Watering once or twice a week may be permitted till after germination, but is not advisable thereafter as the seedlings may feel the want of it when put out in the forest.

Figure II.—Basket Sowings.



(1) Bamboo baskets $9' \times 4\frac{1}{2}'$.
(2) Sandal and host plant seedlings ready for transplanting out with baskets.
(3) Wire netting.

12. The baskets should be planted out with the sandal and host seedlings in them at the commencement of the monsoon.

13. In both the above cases put a light shade over the seed ; this is best done by erecting a pandal about 4 feet high covered with a lacey shade.

14. Seed should be sown three to five months before planting out is to be done. This allows one to two months for germination, after which about two months growth in the dump or basket is desirable.

C.—PLANTATIONS.

15. Making plantations of sandal on a large scale is not advocated in most districts as our knowledge of this species is very limited, and making such plantations is still in an experimental stage ; disease and fires, which are more difficult to control in plantations, are factors of vital importance ; damage by wild and domestic animals is difficult to guard against, except by "tight lock" fencing of some sort, which is expensive ; and finally because the intensive and skilled supervision that is necessary to ensure success is difficult in most cases to provide.

16. In cases where sandal *and hosts* can be raised without difficulty and where other factors are favourable, plantations may be considered advisable.

17. The general object of artificial regeneration of sandal, however, is to ensure its spread over as wide an area as possible. For this purpose the formation of small propagation centres, approximately 10 feet in diameter, is the method that has met with the greatest success. Such propagation centres should be formed only in forests which do not already contain sandal (vide paragraphs 21—31).

18. For the formation of actual plantations raising sandal with field crops in the first instance has met with considerable success in Coorg (where it was tried 50 or 60 years ago and was revived recently by Mr. G. C. Robinson), and on the West Coast generally, where rainfall is sufficient and growth of hosts, as well as of sandal, is rapid (vide paragraphs 32—41).

19. In drier and less favourable localities where it is considered necessary to make plantations, the "line method" of planting is advocated (vide paragraphs 42—45).

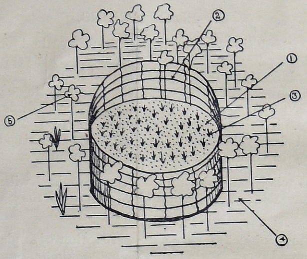
20. In all cases where sandal is artificially regenerated great care must be taken to see that the subordinates do not plant it within three feet of any tree species. They are very liable to overlook the fact that both are intended to grow to a considerable size, and to forget that a sandal seedling planted say 8 inches from a Pongamia sapling will probably be jostling it within 15 to 20 years.

(1) *Propagation centres.*

21. In any locality where it is decided that sandal is to be introduced by propagation centres, select areas containing vigorous and healthy trees to act as hosts, shady as far as possible, and with as much moisture in the soil as can be obtained in that locality. If possible, in the middle of a clump of trees and bushes, otherwise on the shadiest side of such hosts (i.e., generally to the north-east), clear a circular

space 10 feet in diameter, pile up the slash and burn it. Mix the ash and soil together; and introduce sandal at an espacement of about three feet. Broadcast dhall seed to act as preliminary hosts while the sandal is young.

Figure III.—Propagation Centre.



(1) Clearing 10′ × 10′.
(2) Bamboo fencing 5′ high.
(3) Sandal seedlings espacement 3′ × 3′ and dhall represented by dots.
(4) Fire tracing 12′ round propagation centre.
(5) Existing tree hosts outside centre.

22. In these propagation centres the sandal is best introduced, except in very dry climates, where the monsoon is uncertain, by means of small dumps about 5″ in diameter, as described in paragraph 1 (2) above. Dhall seed may be introduced in the dumps at the same time as the sandal.

23. On the West Coast, where the south-west monsoon is certain, such dumps should be put out at the beginning of May.

24. In localities where the south-west monsoon is less sure, and some rainfall in the north-east is usual, the dumps should not be put out until the south-west monsoon has actually broken.

25. Where rainfall is still more uncertain propagation centres may better be regenerated with basket plants, raised in a nursery and, if necessary, kept alive by occasional watering until the monsoon has arrived and no long spell of complete drought is to be expected.

26. In both cases aeration of the soil by forking is advisable sufficiently often to keep it loose.

27. Such propagation centres must be fenced with a strong bamboo, or other fence of such a height as to be approximately half the diameter of the plot. Thus a plot ten feet in diameter would have a five feet fence. The objects of the fence are twofold. First it serves

to keep out browsers ; it is found in practice that neither graziers, cattle nor game consider it worth the trouble of breaking down these fences for the sake of the few sandal seedlings they contain ; further it is probable that deer do not like jumping into what looks rather like a trap, and will, anyway, be difficult to jump out of again. This is one of the advantages that small propagation centres have over larger plantations, where the maintenance of an effective fence is almost impossible, except at prohibitive expense.

28. Secondly, the fence serves as shade for the seedlings in the hot weather ; sandal grows best in a " chimney ", i.e., with lateral shade and overhead light. Care must however be taken that the fence is not made so dense as to impede the proper circulation of air. In grassy areas the grass should be scraped away to a distance of 10 to 12 feet all round the fence, at the beginning of the fire season, *and kept clear.*

29. Propagation centres should be situated in the neighbourhood of a stream bed, if such exists, both because of the greater fertility of the soil due to moisture, and because birds congregate in such places and spread the seed ; and also because the seed is carried down by the water in times of flood and deposited on fertile soil.

30. In many districts it is made a rule that each beat Guard has to prepare and maintain from six to a dozen such propagation centres annually. This is not difficult and can easily be done in addition to *ordinary beat* duties.

31. It is suggested that, in order to avoid having a preponderance of propagation centres in one locality, Forest Guards might be instructed to work over their beats by compartments, taking up one each year in rotation.

(2) *Plantations with field crops.*

32. Where the formation of regular plantations is, for any reason, considered necessary, they may with advantage be formed with field crops, provided, and only provided, the factors of the locality are such as to make the raising of both the sandal and *hosts* an easy matter.

33. An example of a case in which such an operation might be advisable would be a lantana infested area on the West Coast.

34. In such an area all growth is felled and burnt and sandal is raised with field crops, such as ragi, and with dhall sown in a ring round the sandal. Sandal is generally dibbled, but might alternatively be raised in small dumps in situ. If jungle tribes can be found to clear, burn and raise the field crop this is an advantage. The sandal sowing must be entirely in the hands of the department, and should be done early in May. The aim should be to *establish* not more than 150 sandal trees per acre. Later this will probably have to be reduced to 75.

35. A most important point is the eradication of all climbers after burning and before sowing.

36. The practical difficulty that has been met with in this method of regenerating sandal is the absence of permanent hosts for the

numerous thriving sandal seedlings that are generally present at the end of the first year.

37. Probably the best plan is to leave as many host trees as possible, when clearing the area, and to encourage regrowth from coppice. If leaving host trees interferes with the field crops they may perhaps be lopped or pollarded instead of being felled.

38. Or it would seem to be possible to arrange that suitable tree species should be introduced at the same time as the sandal.

39. Suitable hosts for this purpose are in general the faster growing leguminous species, Pongamia glabra, bamboo, Ficus species, etc.

40. Planting cuttings of, and sowing, "Dadap" (Erythrina lithosperma), have been tried with some success; the former is expensive; the latter has been found in Coorg the more promising method.

41. If all the planting is done 6′×6′, the sandal being 12 feet apart, this will give approximately 300 sandal and 900 hosts per acre. Of these 300 sandal, however, only half may be expected to survive which will give the required original stocking.

(3) *Line planting.*

42. In less fertile localities where both sandal and host plants are difficult to raise, *if* regular plantations are decided upon in preference to propagation centres, "line planting" is advocated. By this is meant cutting lines through the scrub jungle, about 6 feet wide and anything up to a chain apart, heaping the slash on the lines and burning it, and then, after working up the soil and ash, introducing sandal by one of the above methods and sowing dhall broadcast.

43. The advantages of this method are (1) that the hosts are not destroyed, and (2) that the young sandal is afforded protection from the sun; for this reason the lines should, as far as possible, run north and south.

44. In places where damage by browsing is anticipated, such areas should be strongly fenced.

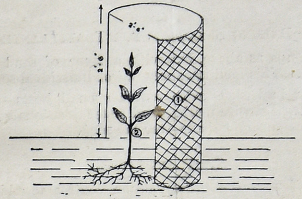
45. It is suggested that where it is considered advisable to go to the expense and trouble of forming regular sandal plantations it is also worth incurring the extra expenditure involved in erecting a wire fence of the "tight lock" type. Such fencing, as is well known, can be used repeatedly.

46. *Tending—Shade.*—Germination of sandal is aided by light overhead shade. This condition is also suitable for young growth up to, say, 4 or 5 years old, or 4 to 6 feet in height. Thereafter lateral shade and overhead light are necessary. Cleanings must therefore be made where sandal is being suppressed. However, to avoid the possibility of destroying what may be an essential host it is often advisable to pollard, instead of felling, trees that are interfering with the development of the sandal.

47. On the other hand young sandal saplings, especially those artificially raised, are often killed by excessive exposure to the sun.

In such cases it has been found useful to put round them shelters about 30 inches in diameter, and 30 inches high, made by inserting four stakes and intertwining bamboo splits or brushwood round them.

Figure IV.—Basket Shade.



(1) Baskets made of brushwood 2½′ × 2½′.
(2) Sandal seedling.

48. *Air circulation.*—Many careful observers have recorded that sandal frequently becomes unhealthy and dies off if it has not a free circulation of air round it.

49. It is suggested that this may be one of the reasons why sandal is often found to be better grown and healthier in cultivation, and in overgrazed forests.

50. The point is one that has not yet been definitely established. It may, however, with advantage, be borne in mind by those in charge of sandal operations.

51. *Creeper cutting.*—Cutting creepers, or poisoning with Atlas Solution if the expense is not prohibitive, on both sandal *and its hosts*, should not be neglected.

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J. E. M. MITCHELL,
District Forest Officer, North Salem.

SUMMARY OF RECOMMENDATIONS MADE.

A.—To induce Rapid Germination.

1. Remove pulp of selected seeds and sow.

2. Dump seed in shallow depression made in the soil and cover with damp straw.

B.—Raising Seedlings for Transplanting.

1. Make dumps as above, but with a layer of sand immediately below the seed. This facilitates removal of individual seedlings.

2. Sow seed in baskets with suitable small hosts such as dhall, cover with straw and wire netting, and water occasionally.

In both cases put light shade over the seed.

C.—Plantations.

1. *Propagation centres.*—Propagation centres should be made in favourable localities, and are for the purpose of aiding the subsequent natural spread of sandal.

They should be about 10 feet in diameter, with fences about 5 feet in height round them.

They must be protected from the sun either by being made in the centre or to the north-east of a clump of hosts. Slash is burnt and the ash mixed with the soil and sandal introduced by one of the above methods.

2. *Plantations with field-crops.*—Plantations of sandal may be made by the " podu " or " taungya " system. It is suggested that it is advisable in such case to introduce hosts with the sandal in such areas. Such plantations are recommended only in fertile and well watered localities such as on the West Coast. They are suitable for replacing almost pure crops of lantana, or other useless growth.

3. *Line planting.*—In drier localities, if plantations are insisted on, they can best be made by cutting 6 feet lines through the scrub jungle, anything up to a chain apart, and burning the slash, and mixing the ash with the soil before introducing sandal by one of the above methods.

In all cases dhall should be sown to afford easy hosts for the sandal in its early youth.

When plantations *are* considered justifiable probably protection with some form of " tight lock " fencing is advisable.

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